MINIMIZING PAPER WASTE CAROUSEL-STYLE DISPENSER APPARATUS, SENSOR, METHOD AND SYSTEM WITH PROXIMITY SENSOR

[0001] This file is a Continuation-in-Part of Serial No. 09/780,733, filed 09 February 2001.

FIELD OF THE INVENTION

[0002] This invention relates to the field of paper roll dispensers. In particular it relates to a carousel dispensing system for paper towels adapted to dispense paper from a plurality of rolls. This invention relates to the field of proximity sensors. In particular it relates to the field of phase-balance proximity sensors. It relates to spurious noise-immune proximity sensors.

BACKGROUND

[0003] As is readily apparent, a long-standing problem is to keep paper towel available in a dispenser and at the same time use up each roll as completely as possible to avoid paper waste. As part of this system, one ought to keep in mind the person who refills the towel dispenser. An optimal solution would make it as easy as possible and as "fool-proof" as possible to operate the towel refill system and have it operate in such a manner as the least amount of waste of paper towel occurs. This waste may take the form of "stub" rolls of paper towel not being used up.

[0004] Transfer devices are used on some roll towel dispensers as a means of reducing waste and decreasing operating costs. These transfer devices work in a variety of ways. The more efficient of these devices automatically begin feeding from a reserve roll once the initial roll is exhausted. These devices eliminate the waste caused by a maintenance person when replacing small rolls with fresh rolls in an effort to prevent the dispenser from running out of paper. These transfer devices, however, tend to be difficult to load and/or to operate. Consequently, these transfer devices are less frequently used, even though they are present.

[0005] The current transfer bar mechanisms tend to require the maintenance person to remove any unwanted core tube(s), remove the initial partial roll from the reserve position, and position the initial partial roll into the now vacant stub roll position. This procedure is relatively long and difficult, partly because the stub roll positions in these current paper towel dispensers tend to be cramped and difficult to get to.

[0006] In order to keep a roll available in the dispenser, it is necessary to provide for a refill before the roll is used up. This factor generally requires that a "refill" be done before the current paper towel roll is used up. If the person refilling the dispenser comes too late, the paper towel roll will be used up. If the refill occurs too soon, the amount of paper towel in the almost used-up roll, the "stub" roll, will be wasted unless there is a method and a mechanism for using up the stub roll even though the dispenser has been refilled. Another issue exists, as to the ease in which the new refill roll is added to the paper towel dispenser. The goal is to bring "on-stream" the new refill roll as the last of the stub roll towel is being used up. If it is a task easily done by the person replenishing the dispensers, then a higher probability exists that the stub roll paper towel will actually be used up and also that a refill roll be placed into service before the stub roll has entirely been used up. It would be extremely desirable to have a paper towel dispenser which tended to minimize paper wastage by operating in a nearly "fool proof" manner with respect to refilling and using up the stub roll.

[0007] As an enhancement and further development of a system for delivering paper towel to the end user in as cost effective manner and in a user-friendly manner as possible, an automatic means for dispensing the paper towel is desirable, making it unnecessary for a user to physically touch a knob or a lever.

[0008] It has long been known that the insertion of an object with a dielectric constant into a volume with an electrostatic field will tend to modify the properties which the electrostatic field sees. For example, sometimes it is noticed that placing one hand near some radios will change the tuning of that radio. In these cases, the property of the hand, a dielectric constant close to that of water, is enough to alter the net capacitance of a tuned circuit within the radio, where that circuit affects the tuning of the RF signal being demodulated by that radio. In 1973 Riechmann (U.S. Patent No. 3,743,865) described a circuit which used two antenna structures to detect an intrusion in the effective space of the antennae. Frequency and

amplitude of a relaxation oscillator were affected by affecting the value of its timing capacitor.

[0009] The capacity (C) is defined as the charge (Q) stored on separated conductors with a voltage (V) difference between the conductors:

$C = Q/V$.

[0010] For two infinite conductive planes with a charge per unit area of σ, a separation of d, with a dielectric constant ϵ of the material between the infinite conductors, the capacitance of an area A is given by:

$C = \epsilon A\sigma/d$

[0011] Thus, where part of the separating material has a dielectric constant ϵ_1 and part of the material has the dielectric constant ϵ_2, the net capacity is:

$C = \epsilon_1 A_1\sigma/d + \epsilon_2 A_2\sigma/d$

[0012] The human body is about 70% water. The dielectric constant of water is 7.18×10^{-10} farads/meter compared to the dielectric constant of air (STP): 8.85×10^{-12} farads/meter. The dielectric constant of water is over 80 times the dielectric constant of air. For a hand thrust into one part of space between the capacitor plates, occupying, for example, a hundredth of a detection region between large, but finite parallel conducting plates, a desirable detection ability in terms of the change in capacity is about 10^{-4}. About 10^{-2} is contributed by the difference in the dielectric constants and about 10^{-2} is contributed by the "area" difference.

[0013] Besides Riechmann (1973), other circuits have been used for, or could be used for proximity sensing.

[0014] An important aspect of a proximity detector circuit of this type is that it be inexpensive, reliable, and easy to manufacture. A circuit made of a few parts tends to help with reliability, cost and ease of manufacture. Another desirable characteristic for electronic circuits of this type is that they have a high degree of noise immunity, i.e., they work well in an environment where there may be electromagnetic noise and interference. Consequently a more noise-immune circuit will perform better and it will have acceptable performance in more areas of application.